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ELECTROLYTE FOR AND METHOD OF POLISHING METAL SURFACES ANODICALLY

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This invention relates to an electrolyte for and to a method of finishing metal surfaces anodically. More particularly the invention relates to the anodic treatment of metals in an aqueous electrolyte containing sulphuric acid and arsenic acid to impart to the surface of the metal a lustrous, mirror-like polish.

It has heretofore been proposed to use various compositions of electrolyte for the anodic treatment of metals. In some cases the object has been to clean the metal surface by the etching action of the electrolyte, while in other cases the etching effect has been reduced to a minimum and the object has been to produce a lustrous, image reflective surface. The anodic treatment of aluminum has a somewhat separate status, since there the purpose is not only to provide a lustrous surface but also to form thereon a dense, adherent layer of aluminum oxide as a protection therefor against corrosion and wear.

I have now found that an electrolyte comprising sulphuric and arsenic acids can be satisfactorily employed in the anodic treatment of various metals and alloys to impart to the surfaces thereof the desired type of finish. In the preferred embodiment of my invention, which will be described more specifically hereinafter, such an electrolyte is employed for imparting a lustrous, mirror-like surface, but its use is not limited to that purpose alone.

It is therefore an important object of my invention to provide an electrolytic solution for use in the anodic treatment of metals generally to impart thereto a desirable surface finish.

It is a further important object of my invention to provide an electrolytic solution for use in the anodic treatment of metals generally to impart thereto a desirable surface finish.

It is a further important object of my invention to provide an electrolyte for and a method of anodically treating metals and alloys to produce thereon surfaces that are highly lustrous and free from the scratches and "piled" layers characteristic of mechanically polished metal surfaces.

Other and further important objects of this invention will become apparent from the following description and appended claims.

A method to which this invention pertains involves making the metals to be treated an anode in an electrolytic bath of suitable composition and passing a current therethrough of sufficient density and for a sufficient length of time to produce the desired type of surface finish, which, more specifically, may be a high lustrous or mirror-like polish.

The electrolyte that I have found to possess the most general applicability comprises a mixture of sulphuric and arsenic acids, or sulphuric acid and a compound furnishing arsenate radicals in solution. For satisfactory results, the combined acid concentration should be at least 50% by weight of the solution, but if it is desired to obtain the highest degree of polish, the minimum combined acid concentration should be not less than 75% by weight. In general, the sulphuric acid should be present within the proportions of from 5 to 60% and the arsenic acid within the proportions of from 5 to 90%, the balance being largely water. All proportions are expressed as percentages by weight.

While it is possible to produce desirable surface effects with mixtures of sulphuric and arsenic acids containing as much as 50% water, I prefer to keep the water content of the electrolyte relatively low, since I have found, in general, that baths containing the lower proportions of water may be operated at lower current densities, and therefore at a lower cost for electrical current. On the other hand, it is desirable to have some water present, the preferred minimum of water content being about 10%, although electrolytes containing as little as 5% of water will be found to work with success.

It will be understood, of course, that during the operation of an electrolyte such as described, there will be a gradual building up of the content of metal salts formed by dissolution of the metal undergoing anodic treatment. There may also be some change in the water content due to loss of water by evaporation or electrolytic decomposition, or due to gain of water by condensation or collection of moisture from the air. The composition of the electrolyte should, however, be kept within the foregoing limits for good operation.

The following will serve to illustrate preferred compositions of my electrolyte for use in the electropolishing of stainless steel, nickel and nickel alloys:

Percentages by weight

	Bath		
	No. 1	No. 2	No. 3
	Percent	*Percent*	*Percent*
Sulphuric acid	36	25	10
Arsenic acid (H_3AsO_4)	47	69	77
Water	17	6	13

With the foregoing compositions of electrolyte, excellent polishes have now been obtained on 18—8, 25—12 chromium-nickel stainless steels, nickel, and nickel alloys, such as Monel metal, and Chromel, operating the bath at a temperature of about 60° C. with an anode current density of 50 to 100 amperes per square foot and upwards.

In general, however, anode current densities varying from 50 to 1,000 amperes per square foot may be employed, depending upon the type of surface treatment that is desired. Higher current densities than indicated by the foregoing range may also be employed, but in that case the higher current cost offsets the saving in time. The length of time to effect the desired results depends upon the magnitude of the current density employed, and to some extent upon the particular metals undergoing treatment and the character of their surfaces initially. Rough surfaces, of course, require a longer time to polish than relatively smooth ones.

As illustrative of the length of time required to effect a high degree of electropolish, 20 to 90 minutes is usually found sufficient. The temperature at which the anodic treatment is carried out, while preferably between 50 and 75° C., may be varied from around room temperature to temperatures only slightly under the boiling point of water.

From the foregoing description of my invention it will be apparent that I have provided a novel composition of electrolyte for use in the anodic treatment of metals.

It will, of course, be understood that various details of the process may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. An electrolyte for use in the anodic polishing of metals, comprising an aqueous solution of sulphuric acid and ortho-arsenic acid, the combined acid concentration being at least 50% by weight and the balance being largely water.

2. An electrolyte for use in the anodic polishing of metals, comprising an aqueous solution of sulphuric and arsenic acids, the sulphuric acid being present in an amount between 5 and 60% by weight and the arsenic acid being present in an amount between 5 and 90%, the combined acid concentration being at least 75% by weight and the balance being largely water.

3. An electrolyte for use in the anodic polishing of metals, comprising an aqueous solution of about 36% sulphuric acid, 47% arsenic acid and 17% water by weight.

4. An electrolyte for use in the anodic polishing of metals, comprising an aqueous solution of about 25% sulphuric acid, 69% arsenic acid and 6% water by weight.

5. An electrolyte for use in the anodic polishing of metals, comprising an aqueous solution of about 10% sulphuric acid, 77% arsenic acid and 13% water by weight.

6. The method of anodically polishing metals, which comprises making a metal article the anode in an aqueous electrolyte of sulfuric and arsenic acids the combined acid concentration being at least 50% and the balance being largely water and passing an electric current therethrough of sufficient density and for a sufficient length of time to effect a polish.

7. The method of electrpolishing metals, which comprises making a metal the anode in an electrolyte comprising from 5 to 60% of sulphuric acid, from 5 to 90% of arsenic acid, the combined acid concentration being at least 75% and the balance being largely water, and passing a current therethrough of sufficient density and for a sufficient length of time to effect a polish on said metal surface.

8. The method of electropolishing metals, which comprises making a metal the anode in an electrolyte comprising about 36% of sulphuric acid, and about 47% of arsenic acid, the balance being largely water, and passing a current therethrough of sufficient density and for a sufficient length of time to effect a polish on said metal surface.

9. The method of electropolishing metals, which comprises making a metal the anode in an electrolyte comprising about 25% of sulphuric acid, and about 69% of arsenic acid, the balance being largely water, and passing a current therethrough of sufficient density and for a sufficient length of time to effect a polish on said metal surface.

10. The method of electropolishing metals, which comprises making a metal the anode in an electrolyte comprising about 10% of sulphuric acid, and about 77% of arsenic acid, the balance being largely water, and passing a current therethrough of sufficient density and for a sufficient length of time to effect a polish on said metal surface.

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